THE REVIVAL OF THE METAL CAN

A WHITEPAPER FROM SHERWIN-WILLIAMS

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AS A PACKAGING MATERIAL, CANS HAVE A GREAT ENVIRONMENTAL BENEFIT

as they perfectly fit the circular economy. Cans can be re-melted into various metal products and recirculated indefinitely. Over the past decades, to preserve food and beverage integrity, manufacturers have added an internal epoxy coating to cans, based on Bisphenol A (BPA) as a building block. BPA has, however, been in the spotlight for several years, as some have claimed that the substance may exhibit endocrine activity (EA). The concern could lead to a widespread phase-out of cans in favour of other packaging materials with a weaker environmental profile. Recently, researchers have managed to develop a can coating that is not based on BPA and maintains the health and environmental performance of the can. There is extensive independent scientific evidence that the coating is not endocrine active (EA). This paper will summarise the benefits of the can as a packaging material, and shortly describe the new coating and how research managed to develop and mature it for commercialisation. Finally, the paper will discuss the perspectives for the circular economy of the metal can, including a pan-European deposit and return system for all cans.

1. THE VALUE OF LIGHT METAL PACKAGING (WHY METAL CANS ARE THE BEST FOOD AND BEVERAGE PACKAGING)

The metal can is an accessible and affordable solution to our need for safe, nutritious and quality food and beverages. The metal can also helps our move towards a circular economy and addresses the global challenge of food waste. By changing the way we produce, store, transport and distribute foods, we can improve our diets, our health and the impact on our natural resources.

A GLOBAL CHALLENGE

- **Food Waste**

Food waste is a global problem. The United Nations Food and Agricultural Organization (FAO) estimates that one-third of food produced for human consumption globally is lost or wasted. This represents a colossal 1,3 billion tons per year.[1] In the European Union (EU), around 20% of food produced is lost or wasted (88 million tons yearly), with associated costs estimated at €143 billion ($160 billion). At the same time, some 43 million European citizens cannot afford a quality meal, including meat, chicken, fish or vegetarian equivalent every second day.[2]

Food waste has a huge environmental impact, accounting for roughly 6% of total EU greenhouse gas emissions (GHG) and puts unnecessary burden on limited natural resources, such as land and water use.[3]

Reducing food waste is a fundamental goal of the EU in line with the Sustainable Development Goals (SDGs), namely SDG 2 (end hunger) and SDG 12 (ensure sustainable consumption and production patterns). The EU's Circular Economy Action Plan aims to help achieve the global SDG Target 12.3, to halve per capita food waste at the retail and consumer level by 2030 and reduce food losses along the food production and supply chains.[4]

The inadequate preservation/protection, storage and transportation of food ranks high among the main reasons for food waste.

- **Nutrition and Health**

  According to the World Health Organization (WHO), good nutrition — an adequate, well balanced diet combined with regular physical activity — is a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity. Globally, 1,9 billion adults are overweight and 151 million children are defined as stunted. 12 of 17 SDGs require good nutrition to be met.

- **Sustainability**

  According to the United Nations (UN), decoupling economic growth from resource use is one of the most critical and complex challenges facing humanity today. Global figures, however, point to worsening trends: domestic material consumption (the total amount of natural resources used in economic processes) increased from 1,2 kg to 1,3 kg per unit of Gross Domestic Product (GDP) from 2000 to 2010. Total domestic material consumption also rose during the same period — from 48,7 billion tons to 71,0 billion tons. The increase is due in part to rising natural resource use worldwide, particularly in Eastern Asia.

Sourced from the United Nations Sustainable Goals website at https://www.un.org/sustainabledevelopment/

THE SOLUTION

Light metal packaging, commonly called the metal can, is one of the best food and beverage packaging solutions available from an economic, health and life cycle point of view. It has a key role to play in reducing food waste, and improving nutrition, health and sustainability.

INCREASED SHELF LIFE:
The high-heat canning process provides safe, quality, nutritious food with the longest shelf life of any type of packaging. While fresh produce can spoil, canned foods are a reliable source of nutritious food.

EFFICIENT GLOBAL DISTRIBUTION:
Cans help ensure that nutritious food can be delivered across the globe in a cost-effective manner. Canned foods and beverages retain shelf life better than other packaging options and do not require refrigeration, thus saving both money and energy through distribution and consumption. The European-made aluminum can has reduced its life-long carbon footprint by 31% between 2006 and 2016.[5]

PROTECTING HEALTH:
The metal can is one of the safest processes for preserving food, preventing the growth of microorganisms that cause foodborne illnesses. Light and oxygen are the main causes of food spoilage and metal cans provide the best barriers against these threats. WHO estimates that 600 million people fall ill after eating contaminated food,[6] thus canned food provides an important public health benefit. There has not been a single documented incidence of food-borne illness from the failure of metal packaging in more than 40 years,[7] a period that has seen the consumption of food and beverages from trillions of cans.

INCREASED NUTRITION:
Canned fruits and vegetables are usually harvested and canned within four hours, locking in nutrients that would otherwise degrade for fresh foods in their transit to market. The heat used in canning improves the preservation of certain nutrients found in fruits, vegetables and proteins without requiring the addition of preservatives. Overall nutrients in canned foods are very stable because they are protected from the deteriorating effects of oxygen. Cans also support people with dietary requirements, such as low-sodium diets, with special cans. Furthermore, canned foods generally contain portion sizes matched with consumption needs. Cans are convenient, long-lasting and perfectly suited to provide nutritious meals for people with a busy lifestyle — both for families and the increasing number of single-households, who do not want to compromise on a balanced, healthy diet. Thus, canned foods are a reliable and affordable source of essential nutrients and proteins, such as fish and legumes, and help us meet our dietary recommendations.

SUSTAINABILITY:
The metal can is the epitome of sustainability. It is durable, resilient and timeless. With an infinite recycling life, the metal can is the most sustainable model to reduce our emissions and pollution. When it reaches the end of its useful shelf life, the can is collected and recycled, time and again, for future use — with no loss of its inherent properties. Up to 75% of the nearly 1 billion tons of aluminium ever produced in the world is still in use today.[8]

ECONOMIC CONTRIBUTION:
Aluminium cans support municipal recycling programs, which often rely on the reselling of recycled materials. The value of recycled aluminium cans is €1.055 ($1.186) per ton on average, while for plastics (PET) and glass it is €201 ($226) and €15 ($17) per ton respectively.[9] The aluminium industry includes over 220 recycling plants in Europe.[10]

STRONG EUROPEAN FOOTPRINT:
In Europe, the can industry is worth €19,2 billion (2016). It employs directly 66.000 people and a further 110.000 indirectly. It spans across most of Europe with production facilities in 25 EU Member States, of which 90% are SMEs. According to Metal Packaging Europe, 98,1 billion units of metal packaging are produced annually in Europe, which represents 15% of the European packaging market (2016).[11] In Europe, the average consumption of metal packaging is four units per week, per consumer.

2. BUT THE METAL CAN CAN'T ACT ALONE (WHY CAN COATINGS MATTER)

Can coatings, or linings, used inside metal cans play a critical role in delivering many benefits of the metal can. Without linings, public health and food safety would be jeopardised. Without linings, food in metal packaged goods would not retain a multi-year shelf life. Put simply, without linings, food integrity would decrease, while food spoilage and the occurrence of serious bacteria-related illnesses, such as botulism, could increase.

Epoxy resins are the most common can linings. They have a proven track record in terms of performance, manufacturability and food safety. Epoxy resins containing BPA have set the standard for performance. The US Food and Drug Administration (FDA), European Food Safety Authority (EFSA) and many other regulatory agencies around the world approve the use of BPA-based coatings in food contact materials. NGOs and consumer advocacy groups, however, have seized on concerns raised by some researchers regarding BPA, to lead an effort to have BPA removed from food containers.

BPA has been banned from infant feeding bottles across the EU since 1 June 2011. In Belgium, Sweden and Denmark, BPA is banned in other materials that come into contact with food intended for infants and children under three years. France has also banned BPA in all food packaging, containers and utensils. In the EU, while BPA is permitted for use in materials that are in contact with food, there is a maximum amount that is allowed to leach out of the material (a tolerable daily intake (TDI) of 0,05 milligrams/kilogram of body weight/day). EFSA is in the process of re-evaluating the risks to public health related to the presence of BPA in foodstuffs.

According to the 2019 Eurobarometer survey, across Europe 51% of respondents say they have heard about traces of materials that come into contact with food, while 16% of respondents are concerned about issues with food contact materials.[12]

Until recently, it has been a challenge to find next-generation coatings that deliver comparable results without the use of BPA. Sherwin-Williams decided to drive innovation and meet the growing demand for non-BPA products, thus providing can makers and brand owners with a non-BPA choice.

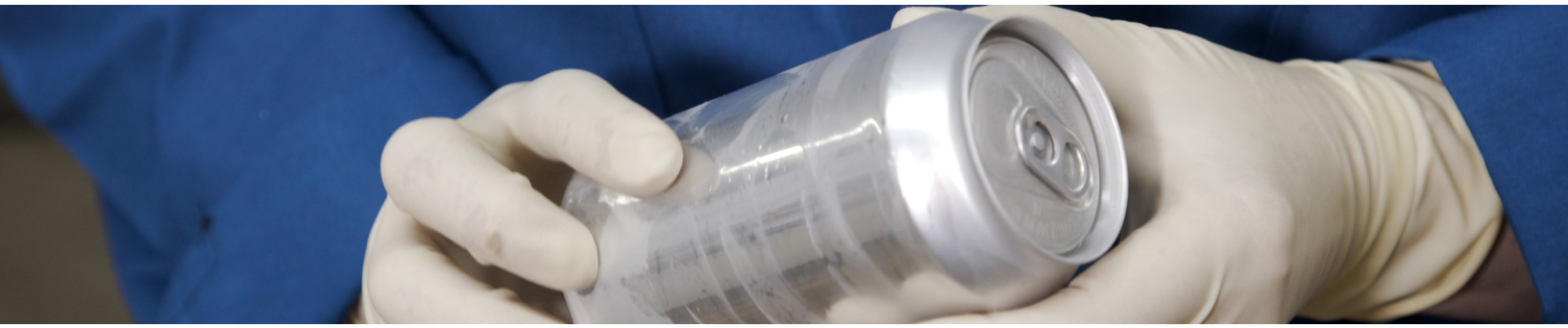
3. WHY VALPURE® V70 – A BREAKTHROUGH THAT MATCHES THE PERFORMANCE OF BPA COATINGS AND DELIVERS A TRUE CIRCULAR ECONOMY

The introduction of valPure V70 solidifies the value of the metal can for producers of food and beverages sold in light metal packaging and the can makers who supply the packaging. It also enhances the metal can's role in global sustainability initiatives and addressing the global challenge of food waste.

The valPure V70 series of non-BPA coatings is the first solution that meets the industry's increasing need for industry-standard performance in non-BPA options for shelf-stable light metal packaging. It matches the performance benefits of BPA-based coatings, but valPure V70 is based on epoxy ingredients that don't contain BPA.

For producers of food and beverages sold in light metal packaging (and the can makers who supply the packaging), valPure V70 delivers the performance brands have relied on for decades from epoxy coatings. This includes corrosion protection, flavour protection and sensory performance. valPure V70 meets stringent international regulatory requirements for food safety and is approved for use in most food packaging applications.

After identifying the monomers that make up valPure V70 through its Safety by Design process,[13] Sherwin-Williams Packaging Coatings encouraged toxicologists, independent laboratories and universities to evaluate the estrogenic activity and migration profile of the ingredients that compose valPure V70. Extensive reviews and testing have shown that valPure V70 (and the ingredients used in valPure V70) has no detectible level of estrogen activity or migration. A recent ruling from the European Court of Justice confirmed that substances used as intermediates in the manufacture of polymers are not automatically exempted from the provisions of the REACH Regulation.[14] This highlights the relevance and necessity of thorough evaluation processes, such as Safety by Design.



Dr. Ana Soto of Tufts University (author of the European Environmental Agency's "Late Lessons from Early Warnings" report,[15] who addressed the BPA concern in 2013) evaluated the monomers that compose valPure V70 using in vitro and in vivo assays. Her findings provide compelling evidence of the absence of estrogenic activity. Dr. Soto published the results of her study in Environmental Science and Technology in 2017.[16]

Through extensive testing, Dr. Michael Mancini, Professor, Molecular and Cellular Biology, Baylor College of Medicine (in association with Cheryl Walker, Professor, Texas A&M University Institute of Biosciences and Technology) found valPure V70 demonstrated low potential for affecting estrogenic or androgenic endocrine activity. His manuscript, "Characterizing Properties of Non-estrogenic Substituted Bisphenol Analogs Using High Throughput Microscopy and Image Analysis" was published in July 2017 in Plos 1, a peer-reviewed, open-access scientific journal published by the Public Library of Science (PLOS).[17]

REGULATORY AND STAKEHOLDER APPROVALS

- **G4:** valPure V70 has received a positive opinion as a starting monomer for polymers for use in food contact coating formulations in December 2016. The G4 is in the process of updating the Dutch Warenwet document to include the V70 materials. The listing includes applicable specific migration limits (SMLs). This Warenwet listing constitutes EU food contact clearance. Under EU mutual recognition rules, this applies across the whole of the EU.

- **CRADLE TO CRADLE PLATINUM CERTIFIED:** Cradle to Cradle is recognized as a preferred product certification by many leading brands, organisations and sustainability standards. valPure V70 meets the Platinum level requirements. These Platinum ratings were based on its achievement in the fields of material health, material reutilization, renewable energy and carbon management, water stewardship and social fairness.[18]

- **ANSES:** The French Food Safety Agency conducted a first review in August 2016. Its Endocrine Activity working group noted no concerns about V70 relating to the endocrine activity issue. ANSES is now analysing further toxicological testing on monomers and oligomers (both in vitro and in vivo).

The innovative breakthrough that Sherwin-Williams has achieved by developing the first non-BPA functional coatings for metal cans has also been acknowledged on several occasions by European stakeholders. This achievement has been recognized by the European Commission in its report on “Chemicals Innovation Action Agenda: Transition to Safer Chemicals and Technologies”,[19] by the NGO ChemSec on its Marketplace listing safe alternatives to hazardous chemicals,[20] and by the Forsythia Foundation in its report on "Safer Materials in Food Packaging."[21]

4. METAL CANS AND THE CIRCULAR ECONOMY

At a time when the world needs to focus on reducing plastic pollution to the environment, it is more important than ever to ensure the safety, recyclability and sustainability of packaging materials. Compared to other food and beverage packaging solutions, light metal packaging is indefinitely recyclable, and thus addresses current challenges of the circular economy.

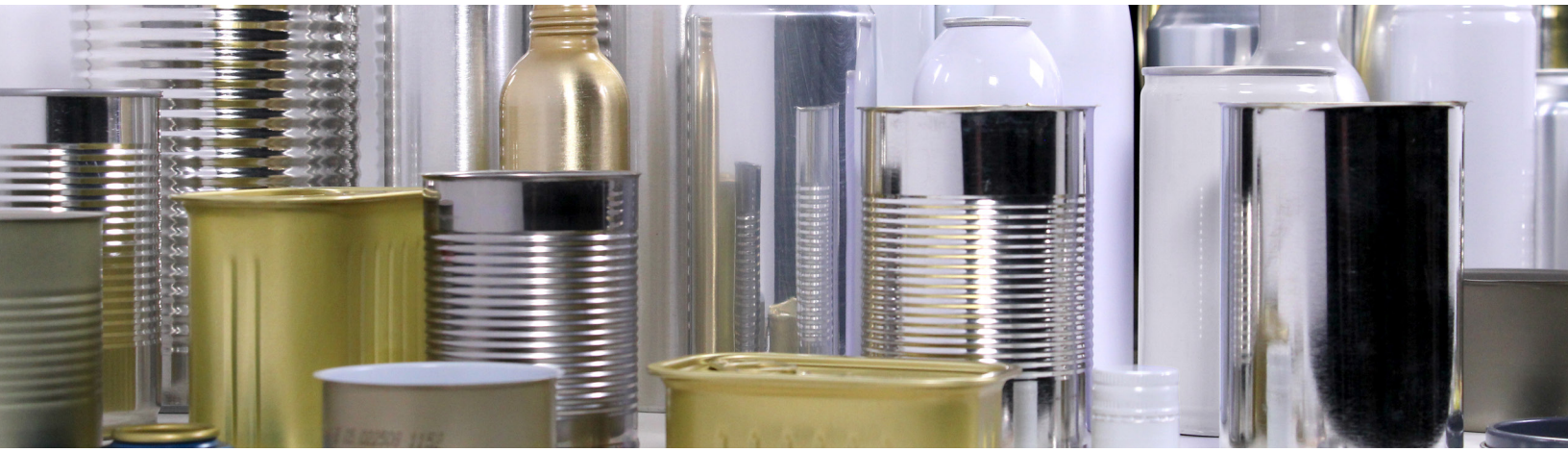
CHALLENGES OF FOOD PACKAGING

Despite the above-mentioned benefits, food packaging can also have a negative environmental impact due to its high production volume, short usage time, and problems related to waste management and littering. Food packaging is generally designed for single use and discarded after relatively short periods of time.

Recent discussions in Europe about single-use plastics have highlighted the need and consumer demand for more sustainable packaging. Sustainable food packaging can save energy, reduce greenhouse gas emissions and prevent food waste. While some goods (such as fruits and vegetables) may not need any protection for shoppers to carry them home — none could be transported from producer to shop without packaging. An average of 72% of European consumers want to buy products with environmentally friendly packaging.[22]

EUROPE'S RESPONSE

In 2015, the European Commission adopted an ambitious Circular Economy Action Plan, which included measures to stimulate Europe's transition towards a circular economy, boost global competitiveness, foster sustainable economic growth and generate new jobs. The circular economy promotes closing loops in production systems, minimising waste, and reducing raw material and energy inputs. It can play a major role in reducing the environmental impact of food packaging.



As part of their ambition to establish a circular economy in Europe, in July 2018, European policy makers adopted the revised Waste Framework Directive (WFD) and Packaging and Packaging Waste Directive (PPWD), which will take effect July 2020. The revised legislation generates a fundamental shift in policy, aiming at creating a well-functioning circular economy through the radical reduction in waste. The new legislation redefined the definition of "recycled" and reset the mandatory targets for each packaging material, creating a consistent approach across all 28 member states.

PACKAGING MATERIALS IN THE CIRCULAR ECONOMY:

Plastic, glass, metal, paper and board, and multi-material/ multilayer are the most common types of food packaging materials, but they all perform differently in the circular economy.

- While reducing material input, such as lighter plastics, can reduce the total amount of food packaging, this can come at the cost of recyclability — forgoing repeated savings of resources and waste prevention.

- While reuse of packaging can accomplish the goals of the circular economy, food packaging reuse is commercially only feasible for refillable and cleanable containers such as glass and metal.

- While in many countries recycling has been implemented for different packaging materials to reduce the quantity of waste and its related environmental impact, there are few incentives to ensure recycled material is used for its original application. Often such material is used for other purposes due to lower functionality, potentially hindering repeated recycling. This practice of downcycling is not in line with the goals of the circular economy.

- Due to a short recycling life, new plastic is always required to make new plastic packaging. This results in a higher carbon footprint and more pollution in our oceans and landfills.

- Recycling of permanent materials, such as metal and glass, is generally considered suitable for food packaging, because the material properties do not change and the heat required for re-melting makes it safe again for use.

MATERIALS USED IN FOOD PACKAGING AND COMPATIBILITY WITH RECYCLING[23]

MATERIAL	MATERIAL LIFETIME	RECYCLABILITY	NUMBER OF CYCLES	RECYCLED MATERIAL USED IN FOOD CONTACT
PLASTICS (PP, PE, PVC, PS, PLA, PHAS, PBAT, STARCH BASED)	NON-PERMANENT	Yes (single thermoplastic polymers)	Limited	Yes
		No (plastic multilayers, thermoset polymers)	-	-
PAPER & CARDBOARD	NON-PERMANENT	Yes	Limited	Yes
METALS	PERMANENT	Yes	Unlimited	Yes
GLASS	PERMANENT	Yes	Unlimited	Yes
MULTI-MATERIAL MULTILAYERS	NON-PERMANENT (PAPERBOARD)	Yes	Limited	Yes
	NON-PERMANENT (PLASTIC)	No	-	-
	PERMANENT (ALUMINUM)	No	-	-

CONSUMER PREFERENCES

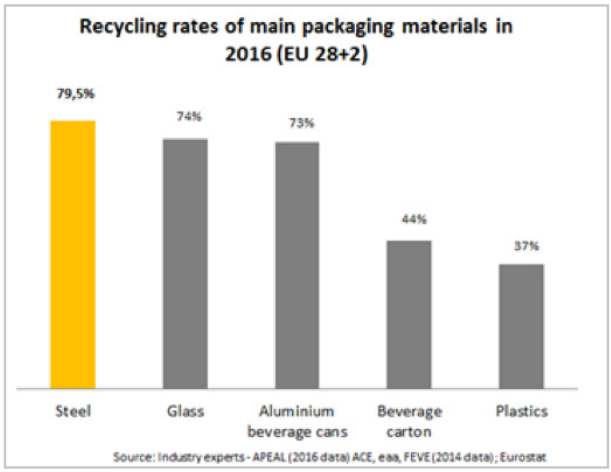
While consumers want more environmentally friendly packaging,[24] they also prefer convenient packaging that adapts to their lifestyle. Globally, the consumer demand for metal cans is strongly growing and expected to reach a value of USD 56,38 billion by 2023 (up by 3,2% from 2018). This is because metal cans are easily consumed on-the-go and they are very convenient. As an example, festivals, beaches and outdoor and sporting events largely allow the use of metal cans, whereas glass is often restricted due to its breakability. Metal cans are also increasingly used to store new types of drinks, such as craft beers, wine, Ready-To-Drink (RTD) spirits and mixers, as cans better protect the taste of alcoholic beverages.

CONSUMER PREFERENCES CONT.

Cans are also starting to replace plastic bottles for still and sparkling water in small quantity units.[25] Furthermore, changing consumer habits shift drinking habits largely from public places to consumers' houses. Due to transport and convenience, smaller packaging sizes such as cans are increasingly popular.

"The latest findings of Beverage Can Makers Europe (BCME) and the German Society for Consumption Research (Gesellschaft für Konsumforschung) reveal that at-home beverage can usage has more than doubled over the last nine years in Germany, while Spain has seen a solid 26% increase. Numbers like these truly testify to the can's privileged position in the packaging mix — and for good reasons." [26] Aluminium and other metal packaging provide both convenience and environmentally friendly, recyclable packaging to consumers.

THE RECYCLED METAL CAN



At a time when more plastics end up in landfills, in incinerators, littering the environment and clogging our oceans — problems exacerbated by China's near-total elimination of the recycling of foreign plastics — metal is the most recycled form of food packaging.

Aluminium is widely used for beverage cans and other types of food packaging (e.g., foils, trays, tubes, beverage cartons, coffee capsules). Aluminium cans represent 90% of beverage cans worldwide and are the most sustainable beverage package on virtually every measure. In a world that is increasingly concerned about scarce resources, aluminium cans have the ability to be recycled over and over, forever, without losing strength or quality. Aluminium cans have a higher recycling rate and more recycled content than competing package types, containing more than three times the recycled content of glass or plastic, with 70% recycled content on average globally. The global recycling infrastructure is already highly advanced. A beverage can recycled today could effectively be back on a retail shelf in the same form within 60 days.[27]

In Europe alone, there is a 73,6% recycling rate for aluminium beverage cans (2015)[28] and 60% across all aluminium packaging (2016).[29] This is well above the recently approved new EU 2025 recycling target of 65% for all packaging. The European Aluminium industry has committed to an 80% voluntary recycling target of aluminium cans by 2020.[30] This is an achievable target given the general properties of the metal can.

ADDRESSING CLIMATE CHANGE

Being endlessly recyclable does not just cut down on landfill space and the need for raw materials. Each can that is recycled greatly reduces energy and therefore the carbon footprint of the next. The recycled metal can also reduces shipping costs and carbon emissions for beverage makers, as it requires up to 95% less energy to recycle aluminium than it does to produce primary metal.[31] Today, the recycling of post-consumer aluminium products globally saves more than 90 million tons of carbon dioxide and more than 100.000 gigawatt hours of electrical energy, equivalent to the annual power consumption of the Netherlands.[32]

A 2019 Life Cycle Assessment (LCA) study of European-produced aluminum beverage cans (25, 33 and 50cl volumes) finds that compared to 2006 data, the carbon footprint has been reduced by 31% on average for the three volumes. Recyclability of aluminium remains the key factor for further life cycle improvements: for every 5% increase of recycled aluminium beverage cans, an average of -6% reduction on climate change impact is achievable.[33]

OUTLOOK FOR A PAN-EUROPEAN DEPOSIT AND RETURN SYSTEM (DRS) FOR ALL CANS

The European Parliament took into consideration the creation of a pan-European DRS for aluminium cans in 2011.[34] The report shows that countries where a DRS has been introduced achieved an extremely positive outcome. Already in 2009, Germany, Finland, Norway, Iceland, Denmark, Sweden and Estonia had a mandatory DRS for aluminium cans, reaching and maintaining recycled rates of near 100%.[35] On the other hand, those European countries without a DRS struggle to achieve even 60% recycling rates.

The example of Finland shows how a DRS can rapidly impact recycling rates. When this measure was first introduced in 1996, the return rate for cans was at 59%, and within just one year, it increased to 79%. By 2009, the return rate was above 90%, and in 2014 it was around 98%.[36] A pan-European DRS has to be given serious consideration.

5. COUNTRY PROFILES

EUROPE

- Recycling rate of aluminium cans (EU, Switzerland, Norway and Iceland): 74% (2015) [37]
- Number of cans recycled: more than 32 billion (including EU and other East-European countries, Russia and Turkey).[38] Every second at least 1.000 aluminium beverage cans are being recycled

GERMANY

- Recycling rate of aluminium cans: 98%
- Aluminium production and processing: 600 plants, providing 74.000 direct jobs (2015)[39]
- Rate of produced aluminium used for packaging: 10%
- DRS in place: aluminium and steel cans, single-use beverage containers, PET plastic bottles, glass bottles (since 2003). Over 40.000 reverse vending machines installed [40]

FRANCE

- Recycling rate of aluminium cans: 57-60% [41]
- Metal can consumption per year: about 5 billion [42]
- Rate of produced aluminium used for packaging: 24% [43]
- DRS in place: not for aluminium cans (in 2018 the recycling company Cycleen launched a partnership with several supermarkets, introducing return machines[44])
- Sales: +7% in sales between 2012 and 2017[45]

DENMARK

- Recycling rate of aluminium cans: 89% (2018)[46]
- Metal can consumption per year: 1,4 billion (2018). Note: this figure includes both metal cans and glass bottles.[47]
- DRS in place: Beer, soft drinks, mineral water, ice tea, cider, alcoholic soft drinks, energy drinks and lemonades are included in the system. From 2020, the DRS will expand to include packaging from juice and drink concentrate products in plastic, glass and metal. The expansion is expected to collect 52 million more bottles and cans than today. 3.111 reverse vending machines and 15.672 manual take back units installed [48]

NORWAY

- Recycling rate of aluminium cans: 95% (2013)
- Metal can consumption per year: 0,56 billion[49] (as for Denmark this figure includes glass bottles[50])
- DRS in place: aluminium cans, PET bottles for beverages (not food or household cleaning), and a small amount of HDPE cans. 700 reverse vending machines in Norway, and 12.000 collection points

6. THE CAN INDUSTRY FOOTPRINT IN EUROPE

In Europe, the can industry is worth €19,2 billion (2016). It employs directly 66.000 people and a further 110.000 indirectly. It spans across most of Europe with production facilities in 25 EU Member States of which 90% are SMEs. According to Metal Packaging Europe, 98,1 billion units of metal packaging are produced annually in Europe, which represents 15% of the European packaging market (2016). In Europe, the average consumption of metal packaging is four units per week per consumer.

APPENDIX

[1] http://www.fao.org/save-food/resources/keyfindings/en/
[2] https://ec.europa.eu/food/sites/food/files/safety/docs/fs_eu-actions_fwm_qa-fight-food-waste.pdf
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[46] https://www.danskretursystem.dk/presse/aarsrapport-noegletal/
[47] Danish deposit and return system does not publish specific figures for metal cans.https://www.danskretursystem.dk/wp-content/uploads/2019/05/%C3%85rsrapport-for-2018.pdf
[48] Shops must take back the types of refillable bottles they sell. In addition, they must take back other refillable bottles that are similar to the ones they sell, meaning bottles of the same shape, volume, outer diameter and height: that is, bottles that can fit into the crates provided by their suppliers.
[49] Number of cans collected via the Norwegian Deposit Return Scheme
[50] https://infinitum.no/english/deposit-facts-of-2013

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